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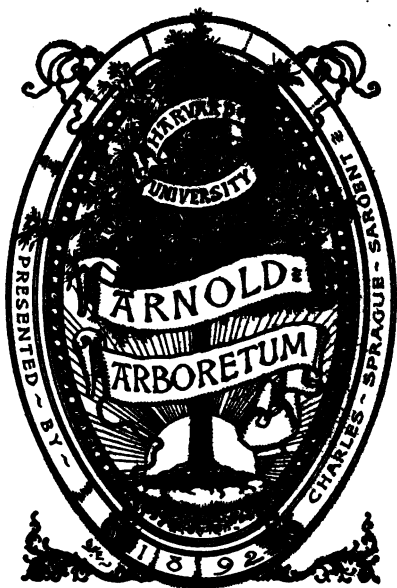
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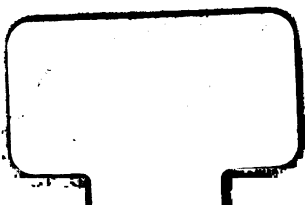
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PROPAGATION
OF
FOREST TREES

HAVING COMMERCIAL VALUE

AND

ADAPTED TO PENNSYLVANIA.

B. GEORGE H. WIRT, *Forester.*

PUBLISHED BY THE
PENNSYLVANIA DEPARTMENT OF FORESTRY.

1902.

WM. STANLEY RAY,
STATE PRINTER OF PENNSYLVANIA.
1902.



Department of Forestry,
Harrisburg, Pa., February 2, 1902.

The frequent demands made upon this office for information as to the best methods of propagating forest trees induced me to request Mr. Wirt, our State Forester, to prepare this bulletin upon the subject. I believe it will be timely and useful.

J. T. ROTHROCK,
Commissioner of Forestry.



LETTER OF TRANSMITTAL.

To Hon. J. T. Rothrock, Commissioner of Forestry:

Dear Sir: I have the honor to submit herewith the following notes on the "Propagation of Forest Trees Adapted to Pennsylvania."

Recognizing the needs of our farmers, I have endeavored to present in a brief and clear way such facts and methods as will bring reasonable success to the inexperienced planter, without making necessary any large expenditure of money. The nurseryman or the forester may find nothing new and may even take exception to many statements.

The botanical names of the trees and their order, for the greater part, is in accordance with Gray's "Manual of Botany," sixth edition. In addition I have added those given by Britton and Brown in their "Flora of North America and Canada," when differing from the nomenclature of Gray.

Very respectfully,

GEORGE H. WIRT,
Forester.

Harrisburg, Pa., February 1, 1902.



THE FOREST NURSERY.

Forestry work does not consist entirely of raising trees from seed and of planting them, although that is a very important part of it. Nor is all planting of trees forestry work. Forestry is a business and must be conducted on a financial basis. Planting individual trees is done mostly from an aesthetic standpoint and at a comparatively high expense. Planting for forestry purposes, under existing conditions, must be reduced to the least possible cost, but it must be understood that more may be lost in this operation from lack of care and attention to the young plants than by trying to save time and money along some other line of work. The methods of raising trees are as varied and as numerous as the trees themselves, the people who plant them and the localities in which they are planted. In other words, the conditions under which each planter has to work are so different that there can be no exact method laid down that will be applicable for all trees and all places. But there are certain laws of plant life in general, and facts in regard to particular trees that, being reinforced by observation of nature and by common sense, will undoubtedly lead to a measurable degree of success. For what follows there is no claim of originality. It is merely a sifted collection of notes taken from the most reliable sources at hand and from the observation of successful nursery work.

Nursery.

Location.—If many plants are to be raised and the planting is to extend over a number of years, a permanent nursery must be prepared. Its proximity to the house of the person in charge will afford the advantage of easy and quick accessibility. Time can be saved in going to and from it. A frequent inspection of its condition and requirements is more likely to occur, and work may be done at odd times. On the other hand, if the planting is to be done within one or two years the nursery might best be placed near the prospective plantation in order to save time in removing the young plants, and to decrease the danger of loss resulting from exposure of the roots to sun and wind. Less preparation is needed, perhaps, in this case, and less care, in some respects, but in either case the following hints are applicable.

Aspect.—The land should have a very gradual slope, and face towards the northeast to give the best results. Good drainage will be obtained; the direct rays of the sun during the growing season are avoided and in spring there is more gradual thaw, a condition that is very desirable, for it is the sudden changes that affect plants most. Other slopes may be used of course, but protection from wind and from the sun must be provided for. As watering will often be necessary, a stream or a spring should be close at hand.

Soil.—The soil should be, preferably, a sandy loam of moderate moisture—neither too wet nor too dry. Heavy soil should be avoided. Whatever land is used, ought to be worked up thoroughly, to a depth of at least $1\frac{1}{2}$ feet, in the fall and again in the spring. More especially should this be done on new land or on land that has not been worked for a long time. The top soil should be well and evenly fertilized. The more thoroughly the working is done the more oxygen for plant life there will be in the soil. The moisture will be better maintained. If the fertilizing is properly done, instead of raising seedlings with long, straggling roots, which cause more or less difficulty in transplanting, there will be produced strong plants with a compact system of root fibres, which is a better result for many reasons.

Beds.—The size of the nursery must be left entirely to the planter himself, but it may be a safe estimate to allow sixteen square feet of bed for every three hundred broad-leaved seedlings and for every six hundred conifers expected from a medium thickness of broadcast sowing.

If transplanting is to be done, fifteen to thirty square feet may be allowed for every one hundred conifers and thirty to sixty square feet for every one hundred broad-leaved seedlings. To prepare the beds stake out the paths or walks at right angles to each other. Shovel about six inches of soil from these and throw it on top of what will be the beds. These may be kept in better shape, then, if boards are placed around the sides, otherwise after each rain more or less soil is washed into the walks, often exposing the roots, or washing out entirely the plants along the edges. Long beds should be about four feet across so as to be worked easily from each side. Of course these are a saving in ground-space, but if there is much danger of damage from mice it is best to have small beds about five feet square. Or a ditch with perpendicular walls around the entire nursery will make it mouse-proof. For taprooted species of trees, such as oak, walnut, hickory, ash, etc., special beds might be made, so as to prevent the forming of long taproots, by placing on about a level with the walks a layer of boards or a very close layer of stones under the beds.

Moisture.—Moisture is one of the most necessary conditions of plant life, consequently the needs of the nursery in this direction

must be carefully attended to. Frequent working of the soil and weeding will make a fine, loose cover for the beds, preventing evaporation to a very great degree. If the soil becomes too dry, watering must be done. Very good results are obtained if the water is allowed to flow through the walks, and to reach the soil in the beds by capillarity. Another good method is to make small irrigation trenches on the beds, fill them and allow the water to soak into the ground. Sprinkling is likely to form a crust which will increase evaporation. After a rain the beds may be too moist. If so, proper conditions can be made by sprinkling some dry sand over the ground. Young seedlings are very likely, too, to have earth spattered over their stems. Especially is this so with conifers and they should be freed of this as soon as possible by running a stick gently over them.

Weeding.—The nursery beds should be kept clean of weeds at all times. If the seedlings have been planted in rows, or in the case of transplants, weeds may be kept out by small billets of wood or by a layer of moss, or of leaves placed between the rows. Weeding should not be done after the first of September at the latest.

Shade.—During the first season's growth, the young plants will be very sensitive and they should be given some protection from the sun. This can be done by making lath frames which will let through about half the sunlight, and by placing them from two to six feet above the beds. Or a frame may be made on which branches can be laid. Some prefer simply sticking conifer branches into the beds in such a way that they form a slight cover. Lath frames are, perhaps, the most convenient, for the shade ought to be removed on cloudy days and during gentle showers. These covers, as well as the billets to keep down weeds, will help to preserve the moisture in the beds.

Seeds.

Choice of Species.—In determining the species to be raised, it is well to observe what trees are growing in the locality, not only within wooded districts but also along fences and in fields. They will give an idea of the quality of the soil and of what may be expected in the future, although this is not always the case, for other better species may have been forced out by some cause. Find out when these trees will have a good crop of seeds and then have everything ready for work when it comes. Not all trees bear seeds every year, as in the case of some oaks and conifers the period varies from two to five years, or even longer. Nor do all seed years produce a full crop of good seeds, as in the case of the tulip-tree. Then some seeds ripen in early summer, however, those of most trees do not ripen till fall, or

even winter. From among these trees in the neighborhood, if they are the proper species, select the healthiest ones and gather their seeds as soon as ripe.

Time of Sowing.—Seeds of the poplars, soft maple, white elm, paper and river birch, and others maturing in summer should be sown at once. They lose their power of germination in a short time. Seeds of oaks, hickories, walnuts, conifers, and others which mature in fall may be sown at once. The freezing and thawing of winter will be beneficial to them, but the destruction by squirrels, mice, and birds that is likely to occur is sufficient reason for not planting until spring, if the seeds can be preserved properly. They should not be allowed to dry out before planting nor should they be exposed constantly to much moisture if they are to be kept for any length of time.

Thickness of Sowing.—By making tests, either by cutting seeds or by placing them between wet flannels in a warm room, so as to produce germination, or by some other method, the percentage of good seed is determined and from this the thickness of the sowing. It is very easy to sow too thick, and then the seedlings will be weak, but it is cheaper to thin out, and perhaps set the young plants in other ground, than to have to fill up blanks.

Depth of Sowing.—The difficulty, in too many cases, has been that instead of the seeds being planted, they are buried. As a general rule, for depth of cover, the diameter of the seed is sufficient, but if the ground is left very loose, or if there is danger from frost late in spring, a heavier covering should be given. It is well, after sowing, to roll the beds or to press the ground with a spade or a board. In fall sowing cover the beds with a layer of leaves. It will prevent the ground from heaving during the time of frost and in the spring will prevent the heavy rains from washing out the seeds. This may be done to advantage, too, after spring sowing. In both cases a careful watch must be kept and as soon as the seedlings appear the leaves should be raked off. Branches might then be spread thinly over them to keep the birds away, but these should not be left on too long so as to in any way interfere with the growth. Small seeds may be coated with red lead as a protection against birds.

Manner of Sowing.—As a usual thing the smaller seeds are sown broadcast in the nursery, especially those of the conifers, the ash, the birch, etc. The larger seeds, as those of the oaks, hickories, walnuts, etc., are usually sown in furrows, or rows, from six to twelve inches apart, on the nursery beds. The latter are often sown in rows where the plants will remain permanently. This may be advisable with with taprooted species. Broadcast sowing over a plantation is very expensive and is very seldom done.

Transplanting.

Age of Plants.—Most plants after they have remained in the seed beds for one season, may be set out where they are to stand finally, especially broad-leaved ones. The spruces and firs grow very slowly during the first four or five years and may best be left two years in the seed bed, then transplanted to other nursery beds and allowed to remain there two or three years. Small and weak seedlings of other species should be treated in the same way. Frequent transplanting is recommended for all species, when especially large and strong plants are needed. In all cases before setting out finally, whether on good or poor land, the object should be to grow and to use only the strongest and best plants. They will be able to resist enemies and hardships and to recover from injuries much better than weak ones.

Time.—Transplanting can be done either in fall or in spring. If done in fall, it should be after the growth has ripened or ceased. During winter the dirt will have a chance to settle about the roots, and by spring the loss of root fibre will be partly made up. On the other hand, frost may lift the plants out of the ground or storms may loosen them. Then, too, they will be exposed to damage from animals at a time when food is scarce. In spring the work should be done as early as possible, at least before the new growth begins. Spring is preferable for conifers.

Distance.—The distance at which plants should be placed finally depends upon the species, the age and the object in view. If fire-wood is the only object then perhaps more wood will be formed per tree by giving as much room and light as possible to the tops. Even in this case it is a question whether close planting is not better financially, if small wood can be used or sold at all. Where it is the purpose to get the soil covered quickly, to raise straight stems clean from branches, either for poles or posts, or later for timber, close planting must be done. For plantations of considerable size, to plant at regular distances and to do it in a systematic way is at all times cheapest. Cultivation may be done more quickly and easily. Blanks may be easily found and filled, and later management is facilitated. Of course mere filling of gaps in existing forests can be done only in a very irregular method.

Roots.—There are numerous methods of planting, but, in all, the most important thing is to take care of the roots. Perhaps more failures could be traced to lack of care of them than to any other cause. They are very sensitive to sun and wind and should never be exposed long enough to become dried out. When the plants are removed from the nursery they should be taken from the beds as care-

fully as possible so that very few roots be broken. Wrap the roots in wet burlap or cover them with moist moss, or place them in thin mud. The plants may then be carried safely to the place of planting. If it is not done at once they should be "heeled in." In planting do not cramp the roots in any way and see that the growing ends are down, and not up. Place fine soil among the roots and pack it thoroughly. If sod has been taken out, turn it upside down on the ground close to the tree. Young plants are sensitive to being planted too deep and so should be no deeper than they were in the nursery. Of course with larger plants, when a great deal of dirt has been loosened, allowance must be made for some settling, but this will not be necessary if packing is well done. When larger roots have been broken or bruised they should be cut off smooth with a sharp knife. Planting can not be done too carefully.

Methods.—In loose and in sandy soil small plants may be set out quickly with the "dibble." This is simply a wooden peg or some iron instrument which will make a hole large enough to have the roots dropped into it. The hole should be made deeper than the roots are long. Place the plant in the hole as far as convenient and then raise it to the proper planting depth. In this way the roots will be in a natural position and not turned up, or to one side. The hole is closed by running the dibble into the ground near the hole and forcing the soil against the roots. This method may be used to good advantage within a forest to fill up blanks if the soil is deep enough.

The most common method, and that applicable under more conditions than any other, is planting in holes that have had to be dug in some manner, as with a spade or hoe. It is necessary for large plants. It is the best method for small plants in heavy soils and in stony places. In fact it may be used anywhere but in the very wet soils. It is well to have the holes dug in fall and allowed to lie open during the winter for spring planting. Humus, rich ground or manure may be used in planting, and if so, should be well placed among the roots, the poorer soil being placed on top. Each plant should be made firm.

On hillsides where a plow can be used terraces may be formed by laying rows of stones along the hill side, or if more time can be taken, by putting in stakes and placing small branches on the uphill side. Run a furrow above this in autumn and during winter the ground will be more or less broken up, facilitating spring planting a great deal. Where a plow can not be used on a slope the only resource is to dig holes just wherever possible and put in strong plants.

In wet soils, swamps or marshes, mound planting may best be used. This is very similar to hole planting, except that the plant is put into the ground thrown out of the hole instead of placing it in the hole itself as in the other cases. If sod has been lifted, split it and

place the plant in the crevice. Here, too, the ground must be thoroughly packed around the roots of the plant. When balls of dirt are taken out with the plants, holes must be dug somewhat larger than the size of the ball on the plant. When this is done the plants may be moved at any time of year and to any place. If the plants are crooked or branchy after planting, cut them off about an inch and a half above ground.

A few trees, such as willows and poplars, may be propagated by cuttings. It is recommended that the cuttings be gathered in fall from last year's shoots and buried during winter. They should be planted in spring while the ground is still moist. They will do well if not gathered till spring, but before the new growth begins, and planted at once. When planting leave one good bud above ground. The others may be rubbed off. Layers or root suckers may be used in a few instances but as a general rule, willows and poplars being an exception, it is better to raise trees from seed.

CUCUMBER TREE, MOUNTAIN MAGNOLIA.

Magnolia acuminata, L.

This tree is nowhere common in Pennsylvania. It is, however, a tree that is worthy of being cultivated because of the peculiar fitness of its wood for pump stocks, watering troughs, etc.

The fruit is a cylindrical mass resembling the cucumber, whence the tree's name. This becomes red in autumn and it is then time to watch for seeds, in order that they may be gathered as soon as ripe. About the last of September, or the first of October, when fully mature, scarlet seeds may be seen suspended from the fruit by delicate white threads. Owing to an oil in the pulp that encloses each seed they become rancid and lose their power of germination as soon as the pulp decays. They should be placed at once in water of 70 degrees to 80 degrees Fahrenheit and macerated for about a week, when the seeds can be thoroughly washed. These should then be fixed in a box in alternate layers of sand and seeds, and kept in a cellar where they will not freeze. As soon as the ground is warm in spring, about the middle of May, they may be sown in furrows from six to eight inches apart, on well prepared seed beds and covered lightly. If any fertilizing is done a small quantity of wood ashes or of bone dust is best. It is said that manure should not be used. The seedlings, after remaining in the seed beds for two years, should be ready for being set out where they are to remain. If intended for lawn planting they may be transplanted every two or three years until wanted.

The tree is found naturally in valleys or coves of mountainous regions, and along rocky streams, preferring deep, rich soil. To do well they must be planted in conditions as near as possible to those under which they do best naturally. Plant in rows from two to five feet apart and from eighteen to twenty-four inches in the row. Close planting will prevent early branching.

SWEET BAY, SWAMP SASSAFRAS, BEAVER TREE.

Magnolia glauca, L.

Magnolia Virginiana, L. See Britton & Brown, Vol. II, p. 48.

The tree never reaches a very great size in this State and is of very little importance except as an ornamental tree. Its flowers appearing in June and continuing for several weeks are very beautiful and fragrant. It prefers moist or swampy soils in a sheltered position. Propagation from seed is the same as that for the cucumber tree, but it may be easily propagated from layers which, it is said, require two years to root. It is frequently grafted upon a root of the cucumber tree and seems to grow better there than on its own roots.

UMBRELLA TREE, ELK WOOD.

Magnolia Umbrella, Lam.

Magnolia tripetala, L. See Britton & Brown, Vol. II, p. 48.

Very seldom found in Pennsylvania, nor does it attain a great size here. Professor Sargent says that it is hardy in cultivation as far north as New England. The branches are very irregular, with leaves at the ends giving the appearance of an umbrella. Large white flowers appear about May, making a very attractive tree. Its propagation is similar to that of the cucumber tree.

TULIP-TREE, TULIP POPLAR, YELLOW POPLAR.

Liriodendron Tulipifera, L.

The tulip-tree is one of the most magnificent of the forest trees and its wood is valuable for many purposes. It is a fairly rapid grower and as it is becoming very scarce its propagation should be encouraged.

The fruit has a cone-like appearance, being made up of a number of scales, on a common axis, from which they fall during winter. Very few of these scales contain seeds and only about ten per cent. of the seeds formed are good. Loudon said that the best cones are found on the higher branches of aged trees. In autumn, as the seeds mature, the fruit turns to a brownish color. The cones should be gathered in October after the first few scales have dropped. Drying them in an ordinary living room for a short time ought to be sufficient to free the seeds from the scales. The seeds may be sown broadcast, or in shallow furrows, in fall, or they may be kept in a dry room until spring. Roll the beds after giving the seeds a slight cover. Soft mold or wood and leaf ashes are good fertilizers for them. In summer do not allow the beds to become too dry and give the young plants some protection from the sun. The plants may remain in the seed beds for two years, to develop a good root system before being planted permanently, or if they are wanted for ornamental purposes they may be transplanted and left two or more years. After transplanting first time it is better to cut the stem off a couple of inches above the ground, allowing a new stem to be formed.

Rich soil of coves and of cool slopes is its preference. It is known to come up in old fields after an advance growth of sassafras or locust, or with locust. Seedlings are plentiful in the forest near old trees after a winter or spring fire has burned the layer of leaves on the ground. It may be set out as the cucumber tree, with locust or with walnut, or with both. Trees are said to be raised easily from cuttings.

BASSWOOD, AMERICAN LINDEN, LIME TREE, LIN.

Tilia Americana, L.

The linden has a one-seeded fruit which when it is matured in September is hard, hairy, gray and about the size of a pea. They should be sown at once in the seed beds, or if kept over winter, should be stratified with moist sand in a box which can be placed in well drained ground. In either case a good percentage will come up the first year, but if they have been kept dry over winter they are likely to wait until the second year before germinating. They are very slow growers from the seed and will have to remain in the nursery for two, three, or four years, and perhaps more, before they will be large enough to set out permanently. They may be then planted with oak, sugar maple, white ash, etc. As with other trees, if the

plants are crooked, or too branchy, cut them off just above the ground and allow a shoot to form. More rapid growth is obtained from layers, so it is customary to cut off an old tree close to the ground, and when a number of shoots have come up, to throw dirt among them that they may take root for themselves. In one or two years they may be cut off and used as plants. Transplanting with balls of dirt is recommended. It prefers a moist situation but will grow on dry soil. As a shade tree it is probably not surpassed.

WHITE BASSWOOD.

Tilia heterophylla, Vent.

The white basswood is more of a mountain tree than the *Tilia Americana*. It is commonly found growing on the moist soil bordering mountain streams, however, it will thrive upon limestone soil, or dry, gravelly and sandy soil, if moderately rich. The wood of this tree is not unlike that of the other species of basswood and is sold as such. It can be propagated the same as the basswood above, either from seed or from cuttings, the latter being, perhaps, preferable.

AMERICAN HOLLY.

Ilex opaca, Ait.

While the holly, under favorable conditions, becomes a tree of good size, and is then valuable, it is not likely that, in this State at least, it will ever be raised for other than ornamental purposes. The fruit is a small red berry, maturing in autumn and remaining on the tree all winter. The berries may be gathered in December and at once macerated in water. After the seeds have been thoroughly washed, they should be spread on a cloth and dried, and then mixed with sand and kept dry until needed for sowing in spring. Sow in furrows ten to twelve inches apart. Cover seeds lightly with fine earth and roll it. A layer of leaves may then cover the bed which will perhaps hasten germination. The seeds are slow to germinate and may not come up until the second year. The plants should be carefully transplanted every two years until set out finally. It seems to prefer the edge of streams or swamps, under other trees, but it will grow on higher ground. It makes a close hedge and requires little care when once started. It is also propagated by cuttings.

OHIO BUCKEYE, FETID BUCKEYE.

Aesculus glabra, Willd.

The wood of this tree is used for pulp wood and for the manufacture of light wooden articles. Although there are other rapid growers, the wood of which is better in quality and may take the place of the buckeye, yet the facility with which it can be raised from seed together with its rapid growth may recommend it.

The fruit resembles the common horse-chestnut but is prickly when young. It matures in autumn and the seeds may be gathered from under the old tree after the first frost. They should be planted at once, either where they are to remain, say two or three feet apart each way, or they may be planted in seed beds, in rows eighteen to twenty-four inches apart and twelve to fourteen inches in the row. Cover a little more than the thickness of the seed, unless the beds are rolled. In one year the plants may be set out. They prefer moist soil, as along the banks of rivers, but will do well in soil that it is not exceedingly dry.

SWEET BUCKEYE.

Aesculus flava, Ait.

Aesculus octandra, Marsh. See Britton & Brown, Vol. II, p. 401.

The tree has a smooth fruit, has the same uses as the Ohio buckeye and may be propagated in the same manner. Either may be used as a shade tree, although the European horse-chestnut is superior and more frequently used for that purpose.

SUGAR MAPLE.

Acer saccharinum, Wang.

Acer Saccharum, Marsh. See Britton & Brown, Vol. II, p. 398.

In the Forestry Report for this State issued in 1895, it is stated that this is one of the largest and perhaps one of the commonest trees in the State. It is apparent therefore that conditions here are favorable to its growth. It is a valuable tree and will grow in almost any locality.

The seeds, in samaras or keys about an inch long, are matured in September. They may be picked from the tree, or a little later swept together under the tree, as they are usually very plentiful. They are very sensitive to being dried out and therefore should be sown at once. The rows should be about eight inches apart and the seeds six inches apart in the rows. A very light cover of earth is sufficient, but put a layer of leaves over the beds for the winter. The seeds may be kept over winter if stratified with sand just slightly moistened, then sown early in spring. During the first season the young plants will need shade. They may remain in the seed beds two years and then be set out permanently at three, four or five foot distances. Prune off any branches that may have formed. The sugar maple has been planted in pure plantations and also in mixture with white ash, walnut, oak, birch and others. It is among the best of the trees suitable for street planting.

What is known as black sugar maple is a variety of *Acer saccharinum* and is propagated in the same manner.

The striped maple (*Acer Pennsylvanicum*, L.), so called from the striped appearance of its bark, is of little importance except as an ornamental tree. Its seeds ripen in September and may be raised as the above. It is found in cool ravines and endures considerable shade.

SILVER MAPLE, WHITE OR SOFT MAPLE.

Acer dasycarpum, Ehrh.

Acer saccharinum, L. See Britton & Brown, Vol. II, p. 397.

This is perhaps the most rapid grower among the maples, and it is adapted to any soil, but it is of very little value. The keys are large, veiny and diverging. The seeds ripen early in summer, in May or June. They may be swept up under the trees and should be sown at once. If planted in moist beds and given a light cover of earth it will not be long before the young plants put in an appearance. Sow the seeds in rows about twelve inches apart and in distances of eight inches in the row. If started in good soil one year will be sufficient time in the nursery, but if in poor soil they will take two years to grow to a size suitable for planting. These plants are apt to branch young, so when planting, if they are branchy or crooked, cut them off just above the ground. The sprout that will be formed will make up for the growth that has been lost.

RED MAPLE, SWAMP MAPLE.

Acer rubrum, L.

The red maple is a more valuable tree than the soft maple and as it thrives in swamps (although not confined to them) which are rarely of any use, there is no reason why it should not be raised. The seeds ripen in May or June and perhaps can best be picked from the tree. They should be planted at once in moist soil, as with the soft maple. The first year they grow slowly and may have to remain in the seed bed two years. Pruning with these, too, may be necessary. Where the soil is good it makes a beautiful shade tree.

BOX ELDER, ASH-LEAVED MAPLE.

Negundo aceroides, Moench.

Acer Negundo, L. See Britton & Brown, Vol. II, p. 400.

In wooded sections of the country this tree is of little value, but in the plains it serves as a splendid "nurse tree" to other more useful species. It is a rapid grower and will thrive on any soil, hence, where a quick protection to the soil, or a quick shade is wanted, there is nothing better; for instance, for the protection of white pine seedlings on a dry southern slope. It is short lived and when planted with other trees affords an early return in the way of fire wood. The seeds are ripe in September and should be sown at once. In one year the seedlings can be planted out. With conifers, box elder may be planted in every other row at four foot distances, the rows being three feet apart. With broad-leaved species every third row would be sufficient.

STAGHORN SUMACH.

Rhus typhina, L.

Rhus hirta, (L.) Sudw. See Britton & Brown, Vol. II, p. 386.

Mostly a shrub but at times reaches the dimensions of a small tree. The wood has a beautiful grain and will take a polish, making it suitable for panels, etc. The fruit (small, hard, strong seeds) is compacted into an irregular, brown or scarlet mass. The seeds mature

about October, after which they may be gathered and sown at once, or kept in a dry, cold place until spring. The sumach is found in thickets, both on the borders of streams and on dry hill sides; it seems to grow more rapidly, however, on the moist soil and usually produces there a stem more or less free of branches.

LOCUST TREE, BLACK LOCUST, YELLOW LOCUST.

Robinia Pseudacacia, L.

The locust has many qualities that recommend it to the tree planter. The foliage and blossoms make it suitable for a shade tree, especially along country roads. It is a rapid grower and can be reproduced easily from seeds or from root suckers. It will grow on any soil that is not wet, and, like all leguminous plants, it improves the soil on which it grows. Moreover the wood is strong and of great durability. Yellow locust wood is supposed to be more valuable than white locust wood, but both come from this species.

The fruit, a pod enclosing several seeds, is matured in September and may be gathered from the tree any time after that, for frequently they remain on the tree all winter. The seeds may be threshed out with a flail and cleansed by running them through a winnowing machine. Field mice are fond of them, consequently it is best to keep them for spring planting, which is easily done if they are kept in a cool, dry atmosphere. Before planting, put them into scalding water and remove them as soon as they swell up. Repeat the operation until all are ready, then plant at once in the seed bed, about six inches apart each way. The young plants may remain in the beds one or two years when they may be set out permanently at four foot distances. At first sight of the borer's work cut off the branch or the whole stem and burn it. If branchy when transplanted pruning will be necessary. It may be planted by itself or mixed with other species, as yellow poplar, catalpa, walnut, etc.

JUDAS TREE, RED BUD.

Cercis Canadensis, L.

Hardly more than a shrub. Its wood is seldom if ever used. In spring the bush is aflame with red flowers, making it worthy of a place on the lawn. The fruit is a legume, or pod, ripening in autumn.

These may be gathered and kept until spring, the seeds to be sown early. It does not seem to be particular as to soil and may be planted under other trees or shrubs. In growth it is fairly rapid.

KENTUCKY COFFEE TREE, COFFEE NUT.

Gymnocladus Canadensis, Lam.

Gymnocladus dioica, (L.) Koch. See Britton & Brown, Vol. II, p. 261.

Very similar to the locust in qualities and requirements. Like all other broad-leaved species it reaches its best development on moist, rich soil. The seeds mature in October and may be taken from the pods readily after a severe frost, or the pods may be gathered and macerated in warm water. Dry the seeds and treat as locust seeds. The growth is rapid, so close sowing is not necessary, neither is the tree so apt to branch as the locust.

HONEY-LOCUST.

Gleditschia triacanthos, L.

This tree as yet has very little value other than as an ornamental tree. It requires rich soil. The pods may be gathered in September or October and macerated in water until the seeds can be washed clean. They can be treated then as those of the locust and coffee tree. The taproot should be cut off before transplanting.

WILD CHERRY, WILD BLACK CHERRY.

Prunus serotina, Ehrh.

A neglected but valuable tree. It is a fairly rapid grower, not particular in regard to soil, and furnishes a fine wood for the manufacture of furniture. The fruit is matured in August. It can then be gathered from the tree and macerated in water until the stones can be cleaned. These may be sown at once, but it is well to preserve them until spring by mixing them with sand and placing the box either in a dry, cool cellar or in the ground where the stones can be

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The fruit, a pod, contains several seeds, is matured in September and may be gathered from the tree any time after that, for frequently they remain on the tree all winter. The seeds may be threshed out with a flail and cleaned by running them through a winnowing machine. Field mice are fond of them, consequently it is best to keep them for spring planting, which is easily done if they are kept in a cool dry atmosphere. Before planting, put them into scalding water and remove them as soon as they swell up. Repeat the operation until all are ready, then plant at once in the seed bed, about six inches apart each way. The young plants may remain in the beds two years when they may be set out permanently at four foot intervals. At first sight of the borer's work cut off the branch or stem and burn it. If branchy when transplanted prune as necessary. It may be planted by itself or mixed with locust, yellow poplar, catalpa, walnut, etc.

AS FREE RED

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frozen. They must not be allowed to become moist. Sow in furrows six to eight inches apart and two or three inches in a furrow. They will be of sufficient size in two years to be moved safely. They may then be mixed with seedlings of ash, elm, oak, pine, spruce, etc., at four foot distances.

Prunus Pennsylvaniaca, L. fil., or the fire cherry, is of little value other than as a nurse tree to better and weaker species. It may be used as the box elder. Propagation is the same as for the black cherry. The fruit is ripe in July.

AMERICAN CRAB-APPLE.

Pyrus coronaria, L.

Malus coronaria, (L.) Mill. See Britton & Brown, Vol. II, p. 235.

The tree never reaches a very great size and its wood is of little value except for tool handles or turnery work. As an ornamental tree, however, it is worth some consideration. Its flowers are numerous, fragrant and of delicate tints. The fruit matures late in fall, when it may be gathered and macerated in water in order to obtain the seeds. Several years in the nursery may be required before the seedlings will be large enough to be planted out with safety. Pruning may be necessary in order to avoid a straggling form. It is usually found in rather moist soil.

MOUNTAIN ASH.

Pyrus Americana, DC.

Sorbus Americanus, Marsh. See Britton & Brown, Vol. II, p. 233.

Of no value other than as an ornamental tree. It grows both on highlands and on lowlands. The berry-like fruit grows in clusters and matures about October. The seeds may be obtained by maceration, and after being dried on a cloth should be kept in a dry, cool place for spring planting. Frequent transplanting before setting out permanently will no doubt secure the best results for ornamental use.

COCKSPUR THORN.

Crataegus Crus-galli, L.

Except for hedges the cockspur thorn is little used. It is occasionally found as a lawn tree because of its white flowers, which appear in June. The fruit matures in October. The seeds may be obtained by maceration and can be sown at once or kept for spring sowing.

JUNE BERRY, SHAD RUSH, SERVICE BERRY.

Amelanchier Canadensis, T. & G.

Another tree, more often a shrub, which is more ornamental than useful. It is among the first of our trees to bloom in spring and is very attractive because of its many white flowers. The fruit matures in June or July and is then edible. The seeds are obtained by maceration and should be sown at once. It has been found on soil varying from dry "barrens" to the wet borders of swamps.

GUM, SWEET-GUM, BILSTED.

Liquidambar Styraciflua, L.

A tree that grows to large size and furnishes a fine grained lumber suitable for veneer and interior finishing. The fruit, a ball with rough projections, matures in autumn, when the seeds drop out. They may be gathered in September or October and sown at once in the seed beds, either scattered thinly broadcast, or in furrows four to six inches apart. Give them a light cover of soil and as with other seeds sown in fall, spread leaves over the beds to protect them during the winter. Two years may be required to allow the seedlings to become of sufficient size to transplant. They may be set in almost any soil, but because of their tendency to branch set the plants not more than three feet apart each way. It presents a beautiful appearance in autumn and is suitable for a lawn tree.

DOGWOOD, FLOWERING DOGWOOD, BOXWOOD.

Cornus florida, L.

As the name implies the tree is conspicuous for its flowers. Its autumn colors are just as attractive, hence as an ornamental tree it is well worth consideration. In order to secure a straight trunk, and a regular shape, plant the young tree, then when it has a year to "root itself" fairly, cut the stem off (in spring or early summer) close to the ground. It will then produce several shoots. Select the one

you prefer and remove the rest. As this retained shoot grows and makes its branches, keep cutting off the lower ones until the stem is as high as you desire, after which it may be trusted to care for itself. It rarely attains great size but the wood is valuable for tool handles, mallets, etc., where it will undergo hard usage. As a forest tree it is scarcely better than a weed, permitting no other species to get a start beneath its shade. The fruit is a small, red berry maturing in September. The berries may be picked from the tree and macerated until the pulp can be removed from the seeds. Mix these with damp sand and place in well drained ground over winter. Plant early in spring. During summer protect from the hot sun. After two years the plants may be set out, either in the open or under the shade of other trees.

The alternate-leaved dogwood, having a "blue-black" berry, is of little value even as an ornamental tree.

TUPELO, PEPPERIDGE, BLACK OR SOUR GUM.

Nyssa sylvatica, Marsh.

Black gum, in favored localities, often grows to a large size. It prefers damp, rich soils but will grow in dry situations. It may be used for landscape work. The wood is hard to split and is used where such characteristic is needed. The fruit ripens in September and may be picked from the tree. Macerate in warm water until the seed or stone is clean. Mix with damp sand and place in ground well protected from moisture. In spring sow about two inches apart in rows. Keep the beds moist. In two years the plants may be moved and should be set two to three feet apart. They are, otherwise, likely to branch.

LAUREL, MOUNTAIN LAUREL, CALICO-BUSH.

Kalmia latifolia, L.

RHODODENDRON, ROSE-BAY, GREAT LAUREL.

Rhododendron maximun, L.

These two shrubs are of little value other than for ornamental use. They are comparatively easy to transplant from the woods. The young plants should be taken up in early spring with considerable dirt to the roots. After transplanting pack a thick layer of leaves about the foot of the shrub and keep them moist until a good growth is evident. Propagation from seed is said to be difficult and expensive. For planting in open grounds it is best to secure specimens which have grown in open grounds.

PERSIMMON.

Diospyros Virginiana, L.

This tree is more valuable for its fruit than for any other purpose. The heartwood, which takes almost a century to form, is very dark. The wood's "capacity for enduring friction is phenomenal." The fruit is mature in autumn and may be picked from the ground under the trees after several frosts. Remove the pulp from the seeds, mix them with moist sand and preserve in a cool cellar. Sow in rows in spring and, as with all slow growing species especially, cultivate well. In two years they may be removed from the seed bed. It grows on light, sandy soil or in bottom land. Occasionally it is found growing on high dry ground. In parts of the United States persimmon culture has become quite common and several improved varieties of the fruit are already produced.

WHITE ASH.

Fraxinus Americana, L.

A magnificent and valuable forest tree. Its wood is extensively used in the manufacture of furniture, wagons, farming implements and oars. It does not seem to be particular as to location, but if the wood of the more rapid growing trees is best, then moderately rich soil where the roots can get plenty of moisture is preferred, as along streams. The fruit is winged and matures in August or September. It should be sown broadcast at once in well raked beds. During the first summer provide shade for it and, if necessary, moisture. The seedlings may be removed when one year old. If the taproot has not been retarded it is better to cut it off than to run the risk of turning the growing end up when planting. It may be mixed with walnut, oak, maple, hickory, etc., at three or four foot distances.

The green ash and red ash are somewhat inferior to the white ash in respect to their timber qualities. If cultivated at all, they may be propagated in the same manner as the white ash.

BLACK ASH, HOOP ASH.

Fraxinus sambucifolia, Lam.

Fraxinus nigra, Marsh. See Britton & Brown, Vol. II, p. 602.

The black ash, growing in wet and swampy soils, although capable of growing on dry soils, is used very much for hoops, basket weaving and interior finishing. Its seeds ripen several weeks later than those of the white ash but are treated in a like manner.

CATALPA, BEAN TREE, INDIAN BEAN, CIGAR TREE.

Catalpa bignonioides, Walt.

Catalpa Catalpa, (L.) Karst. See Britton & Brown, Vol. II, p. 199.

A tree to which a great deal of attention has been called of late. It is a rapid grower on almost any soil, producing, in a very short time, stems large enough for railroad ties or even telegraph or telephone poles. The fruit is a pod enclosing numerous small winged seeds. These pods remain on the trees during winter and may be gathered any time after October. Remove the seeds and keep in a cool, dry atmosphere until the ground can be worked in spring. Sow the seeds broadcast and cover with fine dirt. By the next spring the seedlings can be set out in rows. If by themselves, three or four foot squares will make proper distances for planting. They may be planted with locust, maple, ash, pine, etc. It has been recommended to plant them in alternate rows with field corn. This will afford some cultivation after the plants have been set out. White pine might then be set along the corn rows after one or two crops have been removed. If any damage comes to the young plant, cut it off at the ground, for as long as the root is healthy a sprout will soon come up which will probably produce a better tree than the seedling stems. This indeed, is the best way to secure a trunk long enough and straight enough for a telegraph pole. Cuttings may be used for propagation. The wood, whilst it resists decay in the ground, appears to lack strength sufficient for a good railroad tie.

WESTERN CATALPA.

Catalpa speciosa, Warder.

It is said that the wood of this species is more durable in contact with the ground than that of the *Catalpa* above mentioned. As a rule it produces straighter stems and is freer from branches. The growth is rapid in almost any soil, producing a good crop of telephone poles, etc., in twenty-five years, or less. It can be propagated as the above, either from seed, or from cuttings. Its value for railroad ties has been greatly overestimated.

SASSAFRAS.

Sassafras officinale, Nees.

Sassafras Sassafras, (L.) Karst. See Britton & Brown, Vol. II, p. 97.

Although a rapid grower, the tree will hardly be planted much in Pennsylvania because of its timber qualities. It is very frequently

found in old fields, preparing the soil for a more valuable species and acting as a nurse to it. As such it may be used to advantage. The fruit matures in September. The pulp must be washed from the stone, which should be planted at once in rich, moist soil. Two years will not be too long for the seedlings to remain under nursery care. After they have had a start in the plantation, yellow poplar, sugar maple, white pine and perhaps hemlock might be mixed with it in alternate rows. It sprouts readily and may be raised from suckers or from bits of root.

SLIPPERY ELM, RED ELM, MOOSE ELM. .

Ulmus fulva, Michx.

A tree which is suitable to plant in wet locations, although it is sometimes found on the hillsides. By some the wood is said to be superior to that of the white elm. The fruit is mature in June. It may be gathered from under the tree and sown at once in the nursery beds. If they are dry, moisture should be applied to the beds artificially. Give protection during summer from the sun. If the moisture has been sufficient, the plants may be set out that fall, but it may be best to allow them to remain for another year. Fall transplanting is preferred. It may be mixed with beech, oak, ash, or sugar maple.

WHITE ELM, WATER ELM, AMERICAN ELM.

Ulmus Americana, L.

The white elm rivals the sugar maple in size. Its wood is very hard to split and is used where such resistance is necessary. It, too, prefers moist, rich soil, but will grow in other situations. The fruit is mature in June and should be treated as that of the slippery elm. It may be mixed with birch, beech or maple.

HACKBERRY, SUGAR BERRY.

Celtis occidentalis, L.

Although this tree reaches a fair size, its wood is of no practical importance. The fruit is a small drupe, maturing in autumn. The

seeds may be obtained by maceration and should be sown in moderately moist beds at once. Two years are often required for the seeds to germinate. The young seedlings should have some protection from the sun for several seasons and their roots kept moist. They may be propagated by cuttings.

OSAGE ORANGE, BOW WOOD, BOIS d' ARC.

Maclura aurantiaca, Nutt.

Toxylon pomiferum, Raf. See Britton & Brown, Vol. I, p. 529.

Another valuable but neglected tree. It is a rapid grower and not particular in choice of soil. Its wood has been found to be very valuable in the manufacture of wagon wheels, and has also been used with good success as railroad ties. The fruit matures in October but as it is frequently seedless, and as the tree is readily propagated from cuttings, it may be cheapest to use the latter method. If seeds are obtained after macerating the fruit, they should be kept in a cool, dry atmosphere and sown in spring. The tree is frequently used for hedges, when it needs considerable pruning. In plantations it should be planted closely. It is not a native of Pennsylvania, but is introduced from the southwest.

RED MULBERRY.

Morus rubra, L.

The fruit, resembling an elongated blackberry, is mature in July. It should be picked from the tree and macerated in water, the seeds cleaned and then kept in a cool, dry atmosphere until spring. Sow thinly over the beds and cover with fine dirt. Keep the beds moist and protect the young plants from the sun. After two seasons growth they can safely be placed in the plantation. They endure some shade so may be set among other trees. It prefers low, rich soils.

BUTTONWOOD, SYCAMORE.

Platanus occidentalis, L.

A rapid grower, often reaching a very large size, and not particular as to location. The wood, however, is of very little value, except in

the manufacture of tobacco boxes. The common "button balls" are made up of a number of seeds which mature about October. Sow them as soon as ripe, and cover lightly, or keep them dry over winter and plant early in spring. The seedlings may be planted when one year old.

BLACK WALNUT.

Juglans nigra, L.

A tree valuable both for its wood and its fruit. That it is almost exterminated in Pennsylvania is well known and yet it is a fairly rapid grower and readily propagated from seed. The nuts mature in fall and after a slight frost may be picked up from under the old trees in quantities. Where there is no serious danger from mice and squirrels the nuts may be planted at once (after slightly bruising the hull) in rows about a foot apart, and from four to six inches apart in the row, for they branch early. To prevent the taproot from becoming too long a close layer of stone may be laid before the nursery beds are formed, or the plants may be started in boxes about six inches deep, having holes in the bottom and sides to allow proper drainage. Transplant when one year old. To keep the nuts over winter, remove the "hull" and mix them with moist sand and bury in the ground. Plant as soon as taken up in the spring. If desired, the nuts can be planted at once where the tree is intended to remain. Locust, maple, beech, or catalpa could be mixed with it in the plantation. It might be raised with field corn.

The white walnut or butternut, having an oblong, pointed nut, may be raised in the same manner. It will grow on both high and low ground, whereas the black walnut rarely does well in a dry situation.

SHELL-BARK, SHAG-BARK HICKORY.

Carya alba, Nutt.

Hicoria ovata, (Mill.) Britton. See Britton & Brown, Vol. I, p. 485.

There are said to be nine species of hickory on the continent, but there are only three that are of any importance to us. The shag-bark, so called from the appearance of its bark, prefers rich, damp soil and in such is a rapid grower. The fruit matures in October and may then be gathered from under the trees. They should be placed in moist sand and kept for spring planting. Because of the

taproot it may be best to plant at once permanently, and if possible raise some field crop with the young plants. Make furrows about three feet apart and drop the nuts about every half-foot. Weeds will have to be kept down. If raised in a nursery, care will have to be taken in transplanting, because of the long taproot. Cut off any bruised or broken roots.

WHITE-HEART HICKORY, HICKORY, KING NUT, MOCKER NUT.

Carya tomentosa, Nutt.

Hicoria alba, (L.) Britton. See Britton & Brown, Vol. I, p. 486.

The young shoots of this tree are hairy; the nut angular and pointed. It may be found more frequently and is perhaps the best of the family from the standpoint of forestry because of its choosing the poorer soils, although its slow growth is against it. It is raised as the shag-bark hickory.

PIG NUT, BROOM HICKORY, SWITCH BUD HICKORY.

Carya porcina, Nutt.

Hicoria glabra, (Mill.) Britton. See Britton & Brown, Vol. I, p. 487.

The bark is furrowed on older trees; the fruit is thin shelled. The wood rivals that of the shag-bark, said by some even to surpass it. It will grow both in high and low situations, but in Pennsylvania at least it prefers moist soil. It is also treated as the shag-bark hickory.

BIRCHES.

Betula, L.

Of the five birches commonly found in this State all are more or less valuable or worthy of cultivation. The fruit of the red or river birch and of the canoe birch matures in summer, about June. The small seeds should be removed from the cone-like fruit and sown broadcast at once in moist beds. Of course the plants must be

shaded, at least during the first season's growth. They had better remain in the seed beds for two years. The fruit of the three other birches, black, yellow and white, matures in fall. Their seeds should be kept in damp sand until spring. Sow as early as possible and keep the beds moist during the summer, also shade the plants. In one year these may be removed. Most of the birches will grow on poor soil and may be used as nurse trees for more valuable broad-leaved species. Conifers suffer from having their tender shoots whipped off in a strong wind by the action of the slender stems of these trees and consequently should not be planted with them.

SMOOTH ALDER.

Alnus serrulata, Willd.

Alnus rugosa, (Du Roi) K. Koch. See Britton & Brown, Vol. I, p. 512.

Seldom if ever more than a shrub, but of value, especially for holding soil on banks of streams. The seeds should be picked in October and sown broadcast at once on fresh, sandy soil and covered lightly. Roll the beds and give a covering of leaves for the winter. The seeds are frequently sown upon the snow. If seeds are preserved until spring, when they must be sown very early, keep them in damp sand and in a cold place. Shade the beds during the summer.

IRON WOOD, HOP-HORNBEAM.

Ostrya Virginica, Willd.

A slow growing tree of the poorer soils. It is usually found in the shade of oaks, maples and the larger trees. The fruit resembles the hop. It matures in September. The nut-like seeds should be sown at once and even then may not sprout until the year following. It may be used to plant up blanks, or open places on rocky slopes.

WATER BEECH, HORN BEAM.

Carpinus Caroliniana, Walt.

Usually nothing more than a shrub, though sometimes becoming a tree 25 feet high and a foot in diameter, growing along streams in rich soil. The wood, similar to that of iron wood, is used for levers and turnery work. The fruit matures in autumn and the nut-like seeds should be sown at once in moist, sandy soil. Usually they will not come up until the second year.

OAKS.

Quercus, L.

The oaks may be divided into two general classes, namely the white and the black oaks. The white oaks are those having leaves with round lobes, not being bristle-pointed. The acorns ripen in one year and are sweet to the taste. The black oaks are those the leaves of which have bristle-pointed lobes. The acorns mature in the second year and are bitter to the taste.

Of the first class there are in Pennsylvania, worthy of being cultivated, the following:

White Oak. *Quercus alba*, L.

Post Oak. *Quercus stellata*, Wang. *Quercus minor*, (Marsh.) Sarg. See Britton & Brown, Vol. I, p. 520.

Bur Oak. *Quercus macrocarpa*, Michx.

Swamp White Oak. *Quercus bicolor*, Willd. *Quercus platanoides*, (Lam.) Sudw. See Britton & Brown, Vol. I, p. 521.

Chestnut Oak. *Quercus Prinus*, L.

Yellow Oak. *Quercus Muhlenbergii*, Engelm. *Quercus acuminata*. (Michx.) Sarg. See Britton & Brown, Vol. I, p. 522.

Those of the black oaks are:

Red Oak. *Quercus rubra*, L.

Scarlet Oak. *Quercus coccinea*, Wang.

Black Oak. *Quercus tinctoria*, Bartram. *Quercus velutina*, Lam. See Britton & Brown, Vol. I, p. 517.

Pin Oak. *Quercus palustris*, Du Roi.

Spanish Oak. *Quercus falcata*, Michx. *Quercus digitata*, (Marsh.) Sudw. See Britton & Brown, Vol. I, p. 518.

All of the oaks will grow on poor soil, but since rapid growth of oak produces better wood the better part of soil allotted to forest should be given to them. The acorns mature in fall and may easily be gathered from under the old trees. Those of the black oak class may be sown at once, because of their bulkiness for keeping and because there is no danger from rodents. Those of the white oaks, while they lose their power of germination very soon, but because of the danger from rodents, should be kept until spring in damp sand and in a cool room, or buried with sand in a well drained place. The plants have long taproots and some suggest that the acorns be sown at once in the plantation where the seedlings are to remain. If so done, plough shallow furrows every three feet apart and drop the acorns at a distance of every two or three inches in the furrow. For

several years the seedlings may be cultivated as convenient. If sown in beds scatter from three to four hundred acorns on a bed four feet each way. In one year the plants may be removed and set one foot apart in rows three feet from each other.

CHESTNUT.

Castanea sativa, Mill., var. *Americana*, Watts. & Coult.

Castanea dentata, (Marsh.) Borkh. See Britton & Brown, Vol. I, p. 515.

In the Forestry Report issued by this State in 1895 the following reasons are given for the cultivation of chestnut:

"1. It will grow on almost any kind of soil, from a river flat to a mountain top, although it is not at its best on limestone soils.

"2. It grows with great rapidity.

"3. When cut it reproduces a valuable coppice growth in a few years.

"4. Its product, wood and fruit, will always be in demand.

"5. There will be an increasing demand for it in the future because of the tannin which it contains."

The fruit matures in October, being released from the burs by the first frost. The chestnuts may be sown at once, which is preferable, or they may be mixed in moist sand and buried until spring. Have the soil well prepared. Some sand mixed in the beds will be good. Shade the seedlings during summer. Set out as the oaks, in rows three feet apart and at a distance of one foot from each other in the row. Alternate rows may be set with white pine, or in order to afford cultivation corn might be planted in alternate rows.

BEECH.

Fagus ferruginea, Ait.

Fagus Americana, Sweet. See Britton & Brown, Vol. I, p. 514.

The beech is a tree which should be planted in soil where its roots can get plenty of moisture. The fruit is mature in October and may be gathered from under the old trees. Sow in furrows six inches

apart, the seeds touching each other in the furrows. Shade well. If possible sow the seeds broadcast within an open pine woods, after having raked off the needles. Cover the seeds lightly. The plants may be set out at from two to five years old. It endures shade and may be set under oak, pine, etc.

WILLOWS.

Salix, L.

All of the willows are so easily propagated from cuttings that it is not necessary to waste time by trying to raise them from seed. Last year's shoots can be cut and buried over winter. In spring take an iron bar and make a hole large enough for the cutting to go in. Leave one bud above ground and pack the soil firmly about the remaining part of the cutting.

ASPEN, QUAKING ASP.

Populus tremuloides, Michx.

The poplars are rapid growers. They are found usually along banks of streams, but also on higher ground. In the west the aspen is found coming up on land that has been cleared of other trees, either by "slashings" or by fires. There it prepares the soil for better species, as for instance white pine, and it protects the young plants. The fruit ripens in May or June. The seed is small and "cottony." It should be sown at once in a cool situation and covered lightly. When one or two years old set out in a plantation, as close as convenient. It may branch when young but permits pruning. It may be raised easily from cuttings.

COTTONWOOD, CAROLINA POPLAR.

Populus monilifera, Ait.

Populus deltoides, Marsh. See Britton & Brown, Vol. I, p. 493.

A tree whose wood is being extensively used for paper pulp. It is a rapid grower and adapts itself easily to almost any soil. The most vigorous growth, however, is found on rather moist soil. Thirty

cords of pulp wood to the acre, under average circumstances, might be expected after fifteen or twenty-five years. The tree is frequently found here as a shade tree. The seeds mature in July and should be sown at once. The seed beds should be kept moist. By the next fall seedlings could be set out in the plantation at four or five foot distances from each other. It will make a good nurse tree for white pine, if mixed with it. The quickest and cheapest method of propagation is from cuttings.

WHITE PINE.

Pinus Strobus, L.

It is not necessary to state the uses of this tree nor should it be necessary to state that it ought to be cultivated extensively. It is a rapid grower and prefers poor soil, yields early returns and is very valuable when mature—what more is wanted? The seeds mature in fall of second year and as soon as the cones become pitchy (in August or September) pick them and keep in ordinary living room or some other dry place during winter in bags or on a slat frame, having something to catch the seeds as they fall from the cones. Seventy-five degrees Fahrenheit is sufficient heat to open the cones that the seeds may drop out. Sow broadcast early in spring. Cover lightly and roll the beds. They must be protected from the sun in summer. If the beds become very wet sprinkle dry sand over them as soon as possible. "Damping off" is said to be prevented in this way. If one year old plants are not used in the plantation they had better be transplanted to nursery rows, the rows six inches apart and plants about two inches apart in the rows. During the winter cover with leaves and transplant in spring. Two year old plants may be used safely. If possible have some nurse tree two or three years in advance of the pine, or a rapid grower, set in alternate rows, or two rows of pine to one of the other. Three feet in the row is sufficient. It is worthy of a place as an ornamental tree.

PITCH PINE, YELLOW PINE, JACK PINE.

Pinus rigida, Miller.

This pine has needles in threes. The cones take two or three years to mature. They should be gathered and treated as white

pine. With all pines the seeds must be kept dry during the winter. The oil in them will preserve them so there is very little danger of their losing the power of germination for several years if they are not exposed to moisture. Sow the seeds broadcast in sandy beds in spring. Seedlings can be set out in spring when two years old. They are very sensitive to being transplanted so their roots should be carefully protected. It grows where the soil is extremely poor, but slowly.

SPRUCE PINE, YELLOW PINE.

Pinus mitis, Michx.

Pinus echinata, Mill. See Britton & Brown, Vol. I, p. 52.

Leaves usually in pairs. The cones are somewhat longer than those of the pitch pine but not so large in diameter, proportionally. They mature in one season. Formerly there was considerable yellow pine in this State but it has become very scarce. The tree reaches a large size and its wood is valuable. It is not hard to raise from seeds, which should be treated as those of the other pines. It is a fairly rapid grower and is adapted to dry, sandy soil and to poor slopes.

The red or Norway pine (*Pinus resinosa*) may be propagated as easily from seed as the other pines.

RED SPRUCE.

Picea nigra, var. *rubra*, Engelm.

Picea rubra, (Lamb.) Link. See Britton & Brown, Vol. I, p. 55.

A tree of the highest ridges and cool northern slopes. The cones are small and unusually plentiful. They may be gathered any time after October. By heating the cones some, the seeds will readily fall from the scales. They should be sown in early spring in soil somewhat sandy. Cover the seeds lightly and roll the beds. Shade the seedlings well and do not let the beds become too dry. The plants may be put in the plantation when two years old or they may be transplanted to nursery rows and set out when four years old. They have shallow roots and may be used on rocky slopes. In regular plantations three feet is the proper distance at which the plants should stand from each other.

BLACK SPRUCE.*Picea nigra*, Link.*Picea mariana*, (Mill.) B. S. P. See Britton & Brown, Vol. I, p. 55.

Somewhat smaller than the red spruce. It prefers "sphagnum-covered swamps." Propagation is same as for the red spruce.

HEMLOCK, HEMLOCK-SPRUCE.*Tsuga Canadensis*, Carr.

The cones of the hemlock mature in one year. They are small and egg-shaped, drooping from little foot stalks when ripe. Gather in October. After the seeds have been removed from the cones, keep them in a dry, cool room until spring. Sow broadcast in well prepared beds. Rotten wood mixed with the soil will no doubt insure better success. Moisture and shade are necessary for the young plants. In two years they may be set out finally or transplanted and set out when four years old. While the tree is found in moist and cool places it seems to do well in other situations. The hemlock is, when young, perhaps the slowest grower of all our forest trees and will be the hardest to perpetuate as a forest tree.

BALSAM FIR, BALM OF GILEAD FIR.*Abies balsamea*, Miller.

Frequently found in the northern and colder parts of the State. It makes a fairly rapid growth in well drained soil and can be used for planting along roads or walks. The cones may be gathered in autumn and dried slightly. The scales of the cones will have to be separated from the seeds. They can then be treated as those of the black spruce.

LARCH, TAMARACK, HACKMATAACK.*Larix Americana*, Michx.*Larix laricina*, (Du Roi) Koch. See Britton & Brown, Vol. I, p. 54.

The tamarack is a northern tree and is found only in the cooler parts of the State. While it may be grown on dry soil it prefers and

is usually found in cool swamps. It is a valuable tree and is said to be raised easily from seeds. The small cones mature in September and may then be gathered from the trees. Drying the cones will release the seeds which may be kept in a cool dry place until spring. Sow thinly over the beds and press the seeds into the ground, giving them a slight cover. Protect well during summer. The next fall they may be easily planted out at about five foot distances. Their growth is fairly rapid.

ARBOR VITAE.

Thuja occidentalis, L.

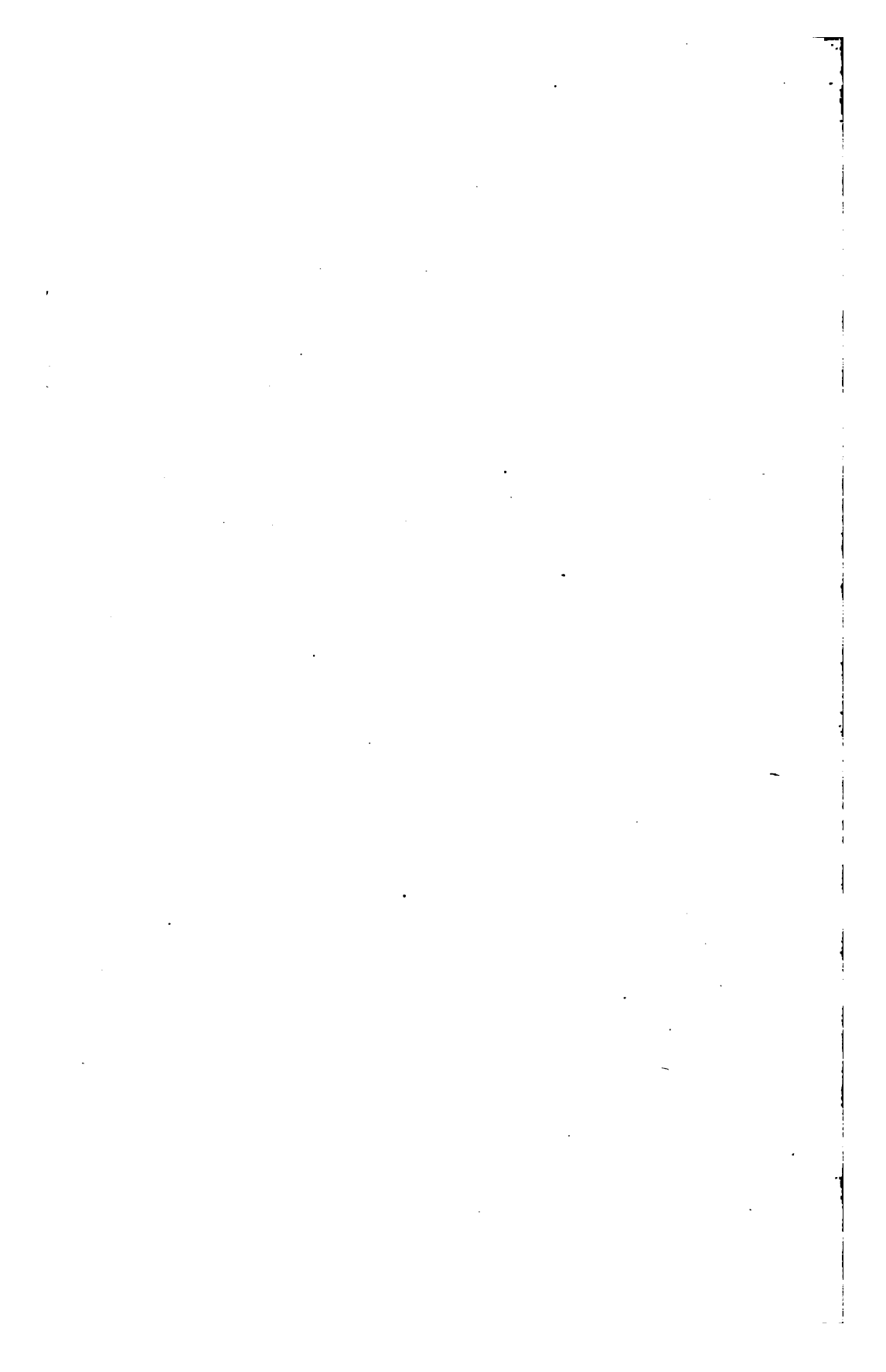
A tree that is of more value perhaps as an ornament than as a tree for forestry purposes, in this State. The stems are used for poles and posts. The cones mature in September or October. It is grown easily from seeds if treated as the other conifers. Two years in the nursery beds is sufficient for the young plants. They may then be placed in the plantation. It occurs naturally, but sparingly in this State.

CEDAR, RED CEDAR, SAVIN.

Juniperus Virginiana, L.

Very common throughout the State, but never reaching a very large size. It is a slow grower. The fruit is a berry made up of several fleshy scales enclosing two or three seeds. The berries may be gathered in November. They should be macerated in warm water or put in strong lye made from wood ashes for several days until the seeds can be washed clean. Keep the seeds dry and cool and sow early in spring. Cover the beds with leaves as it is likely that the plants will not come up until the next year. They may be set out after two years, or transplanted when four or five years old. Set at three feet from each other. This tree is very valuable for fence posts.







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